

THE LARVAE OF *NEBRIA LACUSTRIS* CASEY AND *NEBRIA PALLIPES* SAY (COLEOPTERA, CARABIDAE)

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ABSTRACT

The larval stages of *Nebria lacustris* may generally be separated from those of *N. pallipes* by differences in nasale proportions. When the nasale character is indistinct, stadium-specific head capsule measurements afford reliable species identification.

*Nebria lacustris* and *N. pallipes* are abundant predator-scavengers which are sympatric in riparian insect communities of Vermont. Although imagines are well described (Lindroth, 1961), comparatively little study has been devoted to larvae. We can now offer information relating to identification of the 3 larval stadia and species recognition.

Because of great changes in length with each stadium, total length cannot be used to separate the instars. However, we find that head capsule dimensions are reliable aids for stadium separation (Table I). Additional characters may be used in the field to distinguish 1st instars. First stage larvae are equipped with 2 heavily sclerotized egg bursters on the frontal piece (Fig. 1). Also, the urogomphi of 1st instars bear fewer setae (4-6 each) than those of 2nd and 3rd stage larvae (16-26 each) (Fig. 2).

Andersen (1970) suggests that nasalar proportions and shape of the anterior margin of the frontal piece are useful for identifying several European *Nebria*. We have found that similar features may be used to identify

TABLE I. Head capsule dimensions for separating larvae of *Nebria pallipes* and *Nebria lacustris*.

Dimension	Stadium	<i>N. pallipes</i>	<i>N. lacustris</i>
frontale width	1	.45 mm or less	.45- .52 mm
	2	.50- .60 mm	.60- .65 mm
	3	.70- .75 mm	.75- .85 mm
head width	1	.80 mm or less	.80- .90 mm
	2	.90-1.00 mm	1.00-1.10 mm
	3	1.20-1.30 mm	1.30-1.40 mm
head length	1	.95 mm or less	.95-1.05 mm
	2	1.10-1.20 mm	1.20-1.30 mm
	3	1.30-1.45 mm	1.45-1.55 mm

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most specimens of riparian *Nebria* larvae collected in Vermont (Fig. 3). Known larvae, reared from laboratory-laid eggs, were used for preliminary morphological investigations. Our studies show that the nasale of *N. pallipes* is longer than that of *N. lacustris*. The 2 median nasalar teeth of *N. pallipes* are at least twice as long as the peripheral teeth. When viewed dorsally the nasale of *N. pallipes* also appears narrower than that of *N. lacustris* because it is more acutely rounded with the median teeth on a higher plane than the peripheral teeth. The nasale of *N. lacustris* is flat or, at most, smoothly rounded in its dorsal aspect.

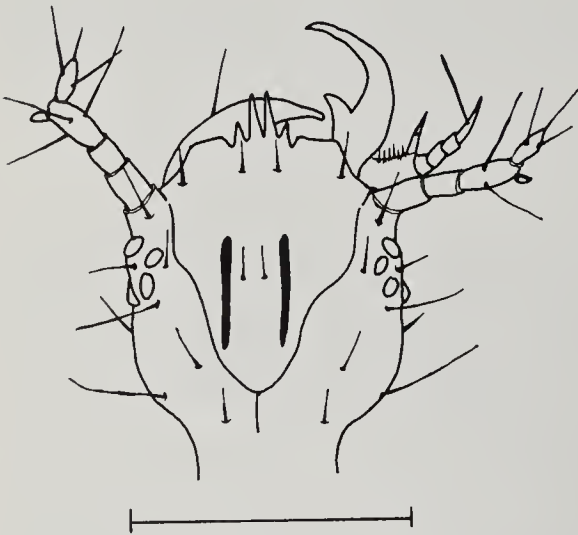


Figure 1

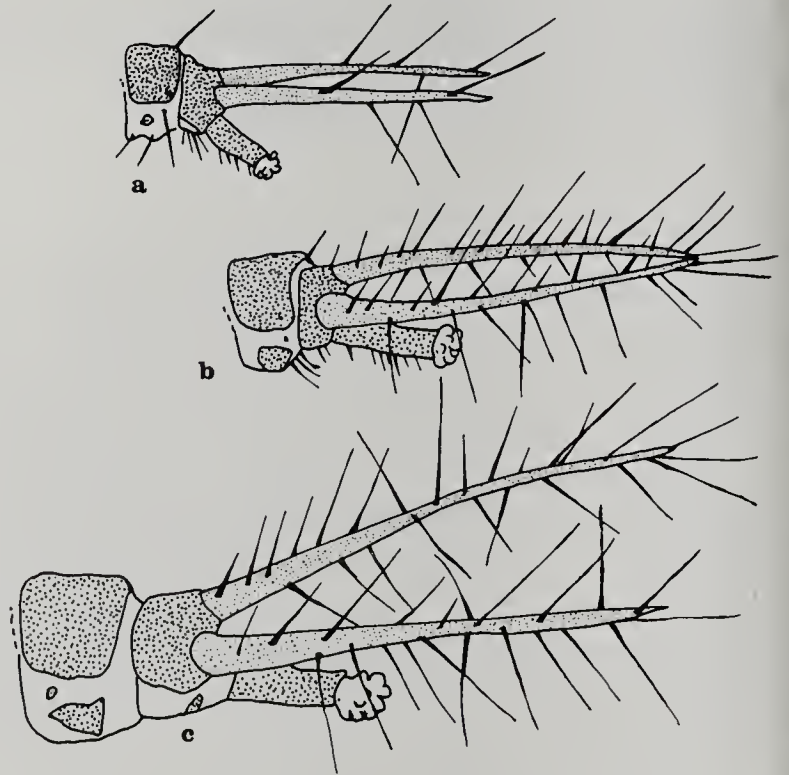


Figure 2

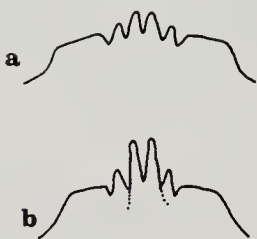


Figure 3

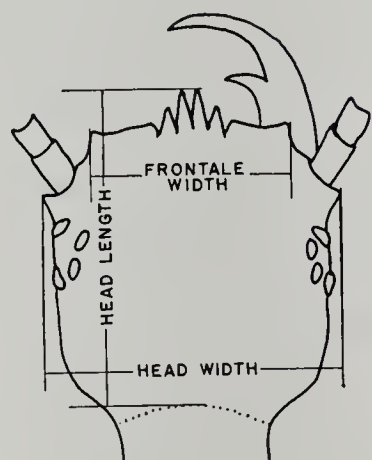


Figure 4

Fig. 1. *Nebria pallipes* Say. First stage larva showing egg bursters.

Fig. 2. *Nebria lacustris* Casey. Urogomphi of (a) 1st stage larva, (b) 2nd stage larva, and (c) 3rd stage larva.

Fig. 3. Front margin of frontale in outline of (a) *Nebria lacustris* and (b) *N. pallipes*.

Fig. 4. Generalized *Nebria* larva head capsule showing dimensions measured for identification.



Although field collected larvae may be generally ordered into 2 groups by use of nasale proportions, a small percentage of intermediate forms (about 5%) are encountered. The possibility of intermediate hybrids seems most unlikely because reproductive isolation mechanisms exist. There are, for example, significant differences in aedeagus morphology (Bell, 1955) and peak breeding times are separated by about 4 weeks in these 2 species (Spence, 1974). In addition, we have never collected intermediate adults despite extensive collecting throughout Vermont.

We have measured 3 head capsule dimensions on laboratory-reared larvae (Fig. 4) and find slight, but consistent species differences (Table I). Relative species dimensions for larvae are not predicted from adult sizes. Although *N. pallipes* is the larger adult form, it is smaller than *N. lacustris* in each larval stage. When the nasale character is intermediate, head capsule measurements afford a method to identify the species after the specimen has been assigned to the appropriate larval stadium. Identification based solely upon head capsule dimensions should be interpreted cautiously in areas where these two species do not co-occur. There is some evidence to suggest that the differences in head size may represent character displacement.

Owing to the reproductive timing differences mentioned above, 1st instar *N. pallipes* co-occur with 2nd instar *N. lacustris* and for analogous reasons 2nd instar *N. pallipes* co-occur with 3rd instar *N. lacustris*. If size difference can be considered as a simple form of structural specialization, as suggested by Hutchinson (1965), the different reproductive timing in these species coupled with the observed differences in head size may aid in reducing interspecific competition (Spence, 1974). The implications of this "strategy" for allowing the broad coexistence of the 2 species will be discussed more fully in a future paper.

We emphasize that *a priori* knowledge of adult distributions is necessary when using this comparative scheme. It is presently unknown how other species of Nearctic *Nebria* may vary with respect to nasalar proportions.

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